

gency to run; if, on the other hand, we hold back the breeze when there is but little sand and a large proportion of alumina, the bricks will be brittle and porous for want of a flux to solidify them.

The colour of bricks appears to depend upon the proportion of the different materials mixed with the clay, and the time taken in burning them, as also the degree of heat used in the latter process. Chalk, when properly prepared and introduced into the material from which bricks are to be made, will have the effect of lightening the colour when burnt. It is very desirable in all cases where chalk is used that it should be washed, to free it from the foreign bodies mixed with it, and get rid of the pebbles, flints, and coarse sand which are intimately connected with it, for they will injure the quality of the brick if not removed. The flint, which is generally abundant in chalk, would do no harm if it was pulverised after being calcined, and then mixed with the clay; it would have the effect not only of whitening the bricks, but also of improving their quality with respect to durability. A superabundance of chalk in clay, tolerably free from siliceous sand, will cause the bricks to be brittle and spongy, especially if it is not carefully incorporated with the mass of the clay by grinding or kneading.

It will be readily gathered from what has been already stated that breeze or ashes constitute a very important element in the manufacture of bricks, for if carefully managed according to the quality of the clay, it may be made to produce very effective results both with reference to colour and quality. The reason why breeze appears to play such a useful part in the process of brickmaking is, I have reason to believe, in consequence of the quantity of sulphur which it generates, or gives out, when fixed in the clump; added to which, it is the principal agent for vitrifying the siliceous particles in the clay, and combining them with the alumina and carbonate of lime, which form the basis of bricks. Most brickmakers prefer breeze or domestic ashes for their work when they can get them; if these are not readily obtained, they have resort to the small broken refuse coke, and sweepings from the gas-houses in the neighbourhood of London, and in rural districts small coal is used in place of the ashes.

The inferiority of coke ashes, when compared with breeze, appears to arise from the different mode in which these articles are made, the former being reduced from coal to coke in close retorts, free from the action of the external air during the process of combustion, while domestic ashes are produced from coals consumed in the open grate, fully exposed to a free current of air during the whole time of being in the fire; so that in the former case the sulphur, gas, &c., are driven off more perfectly than in the latter case; thus, although coke is more highly carbonized than breeze, it is less useful to the brickmaker than breeze, or domestic ashes.

That the sulphur contained in the ashes plays an important part in colouring bricks may, I think, be easily proved without entering into any thing like chemical detail; for if a brick clump is carefully examined when opened, the course which the blue lambent flame of the sulphur has taken may be readily traced by the streaks or deposits of sulphury particles which it leaves on the bricks wherever it has played upon them; and further, also, by the fact that many bricks, though of good colour externally, are often more or less red within. I do not mean to assert that it is the sulphur alone which produces this colour, it is, no doubt, caused by the combination of the sulphur from the ashes with the iron contained in the earths used in the brick, which by the long-continued action of the fire is converted into a peroxide, and this we know gives various colours according to circumstances; it is a question, however, whether the colour would be so good if the sulphur were less abundant, or the brick subjected to the fire with a greater supply of air. Generally speaking, the bricks placed nearest the outside of a clump are of different shades of red, which is either a consequence of being imperfectly burned, or else of the too free absorption of air; the former, however, is believed to be the real state of the case. The rationale of mixing the ashes with the clay is exactly similar to that of mixing the refuse coal from the mines with a large

proportion of clay to make what are called fire-balls, which are much used by poor people in many parts of Wales and in the north of England: it economises fuel, and gives out greater heat than if the small coal were burnt in the open grate, for it evidently first undergoes a process of coking, and then of more perfect combustion; it is during the latter stage that the greatest heat is evolved; hence, therefore, these fire-balls are always put on a fire already well ignited, as they require a considerable degree of heat to set them going. I have often noticed that when these balls are taken from the fire, at their greatest heat just before they break, and allowed to cool gradually, they turn more or less white, which is also a property of all kinds of clay slate, and, as is well known, of pure alumina,—the chief basis of clay itself.

Breeze I consider to be much better for the purpose of brickmakers than small coal, although the latter in most cases would yield more sulphur than the former, but the effect is neutralized by gas which is evolved during the process of combustion in the clump: bricks, therefore, made with small coal are not likely to be so good in colour as those made with ashes.

The effect of adding siliceous sand to clay, as has been already observed, is to hold the particles of the clay more strongly together when under the fire, as a natural tendency of pure clay when subject to great heat is to contract, and frequently in cooling to break up into cracks and flaws, which sand prevents, by fusing and combining itself intimately with the particles of the clay, so that on cooling they are prevented from separating by the powerful cohesive powers of the vitrified sand. Extremes, however, must be avoided, for if there should be an excess of sharp, siliceous sand, it will run into a shapeless mass when in a state of vitrification: if it should be burned too much in this state, it will form what are called clinkers, which are produced by excess of heat and sand.

From what has been stated, it will be perceived that the quality of the brick produced from any given quality of earth will depend upon the skill of the brickmaker, and the judgment he displays in assigning the proportions of the different ingredients he has to add to the clay; it is therefore impossible that any thing like a general rule can be laid down to govern all cases; it may, however, be observed that when the clay is heavy, the addition of chalk will lighten it: when it contains much sand, chalk will be necessary to take up the sand, and keep it from running; if, on the other hand, the earth should be of a marly nature, a little sand will be of service: with heavy earth a larger proportion of ashes will be required than when the soil is light and friable, as it will be more difficult to burn in the former case than in the latter.

With respect to the proper quantity of the different ingredients to be put into a given amount of clay, it may be again observed, that it will depend entirely upon the nature of the earth to be used in making the bricks; in the neighbourhood of London, I find most brickmakers use a different proportion, more indeed by chance than reason, some preferring one thing, some another; some use breeze entirely, while others prefer a mixture of breeze and small gas-house coke; some also would use more chalk than others even with the same description of earth. For myself, I think I should venture to point out the following mixtures, having more especial reference to the clay in the immediate neighbourhood of London, with which I am more familiar than any other. With good clay of average quality, being rather heavy than light, say

Clay.....65	or	Clay.....65
Breeze.....20		Breeze.....15
Chalk.....15		Chalk.....15
		Sand.....5
100 Loads		100 Loads

It will be seen that the quantity of breeze here used is rather less in proportion than most brickmakers generally employ in such cases. With clays of a lighter nature, I should use

Clay.....75	or	Clay.....75
Breeze.....15		Breeze.....15
Chalk.....7½		Chalk.....10
Sand.....2½		
100 Loads		100 Loads

in all which cases, the average of the breeze is lighter than what brickmakers would use, because they are always anxious to burn their bricks as soon as possible; which, in my opinion, is the cause of an unnecessary amount of waste from clinkers and imperfectly burned bricks.

Here I must again be allowed to press upon all brickmakers the absolute necessity of allowing themselves more time if they really wish to make good durable bricks, for they may rest assured that it is scarcely possible to make them good even with the best materials unless they are properly incorporated by careful labour. It is a common practice in London brickfields for the clay after being dug from its bed, merely to be turned over, then it is covered with a layer of breeze or coke-dust for a few inches, and merely mixed together by passing them through the pug-mill, from whence the clay is carried to the moulder, to go through the remaining operations.

It is, however, generally admitted, that the clay ought to be well worked during the winter season, especially during the variable frosts, which tempers it, and renders it more tough and plastic, and in the end a far better material for the purpose of the builder, as the bricks will be all the stronger for the labour bestowed upon them, besides being more close and compact in grain. The action of the frost causes the water in the interstices of the humid clay to swell during the process of freezing, so that in the succeeding thaw it becomes friable and loose in texture, and consequently so much the more easy to be worked. I would, in all cases, recommend the clay and chalk to be well washed and cleaned before they are used, as that will improve both the appearance and quality of the brick beyond measure, and turn out articles worth looking at, good in colour, and tough in quality; quite different from the rotten, soft, and porous things now so commonly used, I am sorry to say, in situations where they ought never to be have been permitted.

Time and labour I am fully persuaded is of the very greatest importance in brickmaking, but as these ingredients are expensive, it is not likely that my solitary voice will be able to induce brickmakers to be more liberal in the use of them in the preparation and manufacture of their earths, as well as in the burning of their bricks in the clamps; if such was the case, there would not be such an overabundance of imperfect bricks as now deluge the market, and damage and deface almost every new building in or near the metropolis.

I shall devote what little space now remains to your correspondent, who signs himself "An Early Subscriber," in your last number. Whatever may be the spirit in which his queries are put, I beg to assure him that if any of my opinions and statements are erroneous, I shall be most happy to be corrected, as I at least am anxious to elicit truth, and not to propagate error. If any of your readers should not approve of the opinions I have expressed, I hope they will at once explain their reasons for not doing so, and at the same time convey as much information on the matter as they possibly can, as this subject is one not yet very well developed, and is capable of great extension and improvement.

With respect to the first question of your correspondent, I can at present only refer him to what I have stated above, and in my former letter. With respect to the second, I think he must be a very "young brickmaker" indeed if he cannot tell when his materials are properly mixed. If in taking up a shovelful of the prepared earth he can see streaks or layers of breeze, or sand, and lumps or layers of chalk, he may rest assured that his materials are far from being properly mixed, and ought to be immediately reground. If the earth is well prepared, it will be of a uniform colour throughout, and he will neither be able to detect breeze or chalk in a separate state; to be properly mixed, they must be thoroughly incorporated one with the other.

For want of time, I must pass over the first part of the third question, and say of the remainder that I believe the articles would certainly be better mixed together, and that I have no reason to fear that the burning qualities of the breeze would be damaged by being mixed with the clay for a few of the winter months.

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